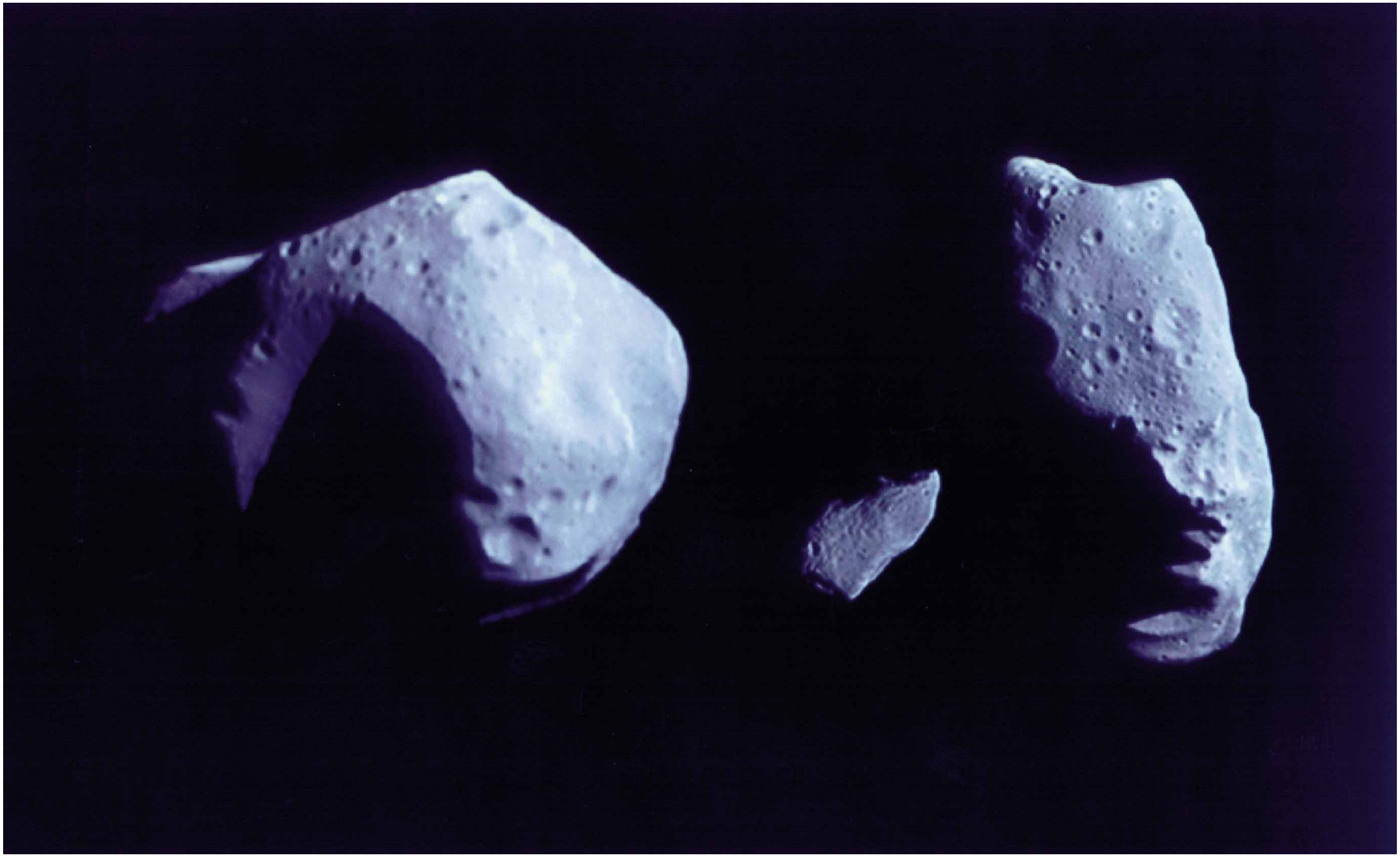
National Aeronautics and
Space Administration

Asteroids: Mathilde, Gaspra, Ida



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ASTEROIDS are rocky fragments left over from the formation of the solar system about 4.5 billion years ago. Most of these fragments of ancient space rubble—sometimes referred to by scientists as minor planets—can be found orbiting the Sun in a belt between Mars and Jupiter. This region in our solar system, called the Asteroid Belt or Main Belt, contains thousands of asteroids ranging widely in size from Ceres, which at 940 km (580 miles) in diameter is about a quarter the size of our moon, to bodies that are less than 1 km (0.5 miles) across.

Revolving around the Sun in eccentric (that is, elliptical rather than circular) orbits, asteroids occasionally collide with each other, knocking themselves out of the Main Belt and hurtling into space across the orbits of the planets. Scientists believe that stray asteroids or fragments of asteroids may have slammed into Earth in the past, playing a major role both in altering the geological history of our planet and in the evolution of life on it. Some even surmise the extinction of the dinosaurs 65 million years ago may have been linked to a devastating asteroid impact near the Yucatan peninsula in Mexico.

It was only in the early 1800s that asteroids were first observed with telescopes by astronomers, and it was in 1802 that astronomer William Herschel first used the word “asteroid,” which means “starlike” in Greek, to describe these celestial bodies. Most of what we have found out about asteroids in the past 200 years has been derived from telescopic observation. Ground-based telescopes are used to watch asteroids that orbit close to Earth, not only to detect new ones or keep track of them, but to watch for any asteroids that might collide with Earth in the future. Two of these ground-based telescopes are the Near Earth Asteroid Tracking telescope on the rim of the Haleakala Crater, in Maui, Hawaii and the Spacewatch telescope on Kitt Peak in Arizona.

In the last few decades, astronomers have used instruments called spectroscopes to determine the chemical and mineral composition of asteroids by analyzing the light reflected off the asteroids’ surfaces. Another means scientists use to study the makeup of asteroids is by examining meteorites. Meteorites are chunks of space debris that fall to Earth and are believed to be of asteroidal or cometary origin.

What do asteroids look like? The first close-up images of asteroids were captured in 1991 and 1993 by NASA’s spacecraft *Galileo* when it flew by two asteroids in the Main Belt on its way to Jupiter. Its pictures of asteroids Gaspra and Ida showed them to be irregularly shaped objects, rather like potatoes, riddled with craters and fractures, 19 km (12 miles) long and 52 km (32 miles) long respectively. *Galileo* also discovered that Ida has its own moon, Dactyl, a tiny body in orbit around the asteroid that may be a fragment from past collisions.

In order to learn more about these intriguing primordial bodies that hold clues to the origin and evolution of our solar system and the history of Earth, NASA has planned a number of missions to study asteroids. Its *Near-Earth Asteroid Rendezvous (NEAR)* spacecraft, which was launched in February 1996, is the first dedicated scientific mission to an asteroid. *NEAR’s* primary goal is to rendezvous with asteroid Eros in January 1999, to study its surface, orbit, mass, composition, and magnetic field (if any). During its journey to Eros, *NEAR* passed by asteroid Mathilde in June 1997. *NEAR* came within 1200 km (745 mi) of Mathilde (the closest encounter with an asteroid to date) and returned close-up images of the carbon-rich, irregularly-shaped asteroid. NEAR’s investigations of Eros will directly address some of the mysteries of asteroids, their relation to comets and meteorites, and ultimately the place of asteroids in the history of planets.

Through the New Millennium Program, NASA will launch the *Deep Space 1* spacecraft in July 1998, to test advanced technologies as it flies by asteroid McAuliffe (named in honor of schoolteacher Christa McAuliffe) in January 1999. The probe will fly between 5 -10 km (3 - 6 mi) from the asteroid, which is the closest any spacecraft has ever flown by a celestial body, and will image and study the asteroids surface. In January 2002, the Japanese will launch their *MUSES-C* spacecraft, which will arrive at asteroid Nereus in May 2003. The spacecraft will carry a tiny NASA rover, the *MUSES-CN*, which will be dropped off the spacecraft onto the asteroid to travel across and investigate the surface of the asteroid.

Fast Facts

	Gaspra	Ida	Mathilde
Distance from Sun (At Perihelion) (A.U.)	1.82	2.74	1.94
Period of Revolution	3.28 Years	4.84 Years	4.31 Years
Length	19 km	52 km	61 km
Inclination of Orbit to Ecliptic	4.10°	1.14°	6.71°
Eccentricity of Orbit	.173	.042	.266
Rotational Period (Hours: Minutes)	7:03	4:38	417:36
Absolute Magnitude	12.9	11.05	10.2
Asteroid Type	S	S	C

Significant Dates

1801— First asteroid, Ceres, discovered by Piazzi
1884— Asteroid Ida discovered by Palisa
1898— Asteroid Eros discovered by Witt
1916— Asteroid Gaspra discovered by Neujmin
1991— *Galileo* captures first close-up images of asteroid (Gaspra)
1994— *Galileo* discovers first satellite (Dactyl) of an asteroid (Ida)
1996— *NEAR* launched; encounters asteroid Mathilde
1998— *DS-1* launched
1999— *NEAR* and *DS-1* encounter asteroids Eros and McAuliffe
2002— *MUSES-C* launched (Japanese)
2003— *MUSES-C/N* rover lands on asteroid Nereus

About the Image

These are views of the three asteroids that have been imaged at close range by the Galileo and Near Earth Asteroid Rendezvous (NEAR) spacecraft. The image of Mathilde (left) was taken by the NEAR spacecraft on June 27, 1997. Images of the asteroids Gaspra (middle) and Ida (right) were taken by the Galileo spacecraft in 1991 and 1993, respectively. All three objects are presented at the same scale. The visible part of Mathilde is 59 km wide by 47 km high (37x29 miles). Mathilde has more large craters than the other two asteroids. The relative brightness has been made similar for easy viewing; Mathilde is actually much darker than either Ida or Gaspra.

References

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